

# Work Order ID 73808

Thursday, September 15, 2011 3:58:08 PM

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Item ID: D350-748-201

Accept

Revision ID:

Item Name: Crosstube Installation, High Aft

Start Date: 9/15/2011 Start Qty: 1.00

Required Date: 10/6/2011 Req'd Qty: 1.00

Reference:

Approvals: Process Plan:

Date: 11-09-15

Tooling:

Date:

QC:

Date:

SPC (Y/N):

Date:

Run Start

Stop

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

Draw Nbr

Revision Nbr

D350-748-241

F

100

0.00

DC

DOCUMENT CONTROL

Memo

0.00

Document Control

Photocopy bluefile & type labels per PPPD350-748-201

CHG002

110

0.00

CNC Bend 2

BENDING MACHINE - CROSSTUBES

Memo

0.00

CNC Alpha 160 Bender

Bend tube as per Dwg D350-748-241 using CNC bender program D350A and Folio FT

xxx under bend by 0.75" nominal per size

120

0.00

QC

QC15- Crosstube Dimensional Check

Memo

0.00

Quality Control

DP 12-6-7

SEP

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
12/6/25	11b	Rippling at bottom of bond.	CP 12/4/25	5% crushing, ie. visible but no more crushed than other tubes.			CP 12/4/25	
			CP 12/7/17	↳ Rippling very noticeable after paint. SCRAP TUBE BASED ON DS EMAIL			CP 12/7/17	

**NOTE:** Date & initial all entries

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Reference:

Run Start



Approvals: Process Plan: \_\_\_\_\_ Date: \_\_\_\_\_ Tooling: \_\_\_\_\_ Date: \_\_\_\_\_

Stop



QC: \_\_\_\_\_ Date: \_\_\_\_\_ SPC (Y/N): \_\_\_\_\_ Date: \_\_\_\_\_

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

125

0.00



HandFXtube

Memo

0.00

Hand Finishing Crosstubes

\*\*\*Stress relief\*\*\*

Heat treat crosstube as per QSI010 4.3

Temp: \_\_\_\_\_

Start time: \_\_\_\_\_

Finish time: \_\_\_\_\_

ATTACHED

127

0.00



QC

QC5- Inspect part completeness to step on W/O

QUT

Memo

0.00

Quality Control

**POSITIVE RECALL**EFFECTIVE 12/6/17 AUTH GP

RELEASED \_\_\_\_\_ DATE \_\_\_\_\_

TURN DIMS 12/6/19

W/O:		WORK ORDER CHANGES					
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Approvals: Process Plan: \_\_\_\_\_ Date: \_\_\_\_\_ Tooling: \_\_\_\_\_ Date: \_\_\_\_\_

Stop



QC: \_\_\_\_\_ Date: \_\_\_\_\_ SPC (Y/N): \_\_\_\_\_ Date: \_\_\_\_\_

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
130	Crosstubes	0.00							
	Crosstubes								
Crosstubes	Memo	0.00							
Crosstubes	1-Drill Tube as per Dwg D350-748-241 Using DT8876 Drill Jigs, Set-up drill table as per QSI 010								
	2-Deburr								
	3-Engrave Part # and Batch # as per Dwg D350-748-241								
	4-Remove all marks from tube within limits of D350-748-241								
	5- <del>Apply a light coat of LPS3 on the interior of tube</del> N/A								
	Batch: _____								
140	QC6- Inspect dimensions to drawing	0.00							
	QC								
Quality Control	Memo	0.00							

**POSITIVE RECALL**EFFECTIVE 12/6/11 AUTH CP  
RELEASED CP DATE 12/6/11

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

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QC: \_\_\_\_\_ Date: \_\_\_\_\_ SPC (Y/N): \_\_\_\_\_ Date: \_\_\_\_\_

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

150

Outsource process-Cadplate per QSI017 4.1.9.1

0.00



Outsource3

Memo

0.00

Outsource process - Cad plate

Issue P/O: 17184  
Stress relief at 375° for 5 hours  
Magnetic Particle Inspect per ASTM E1444  
Cadium Plate per AMS-QQ-P-416B, Class 1, Type 2  
Embrittle relief at 375° for 8 hours, Chromate Treat  
Possible Supplier: Southwest United Industries  
Ensure Certificate of Conformity is attached

CZ 12/06/11 ①

160

Receive & Inspect for Damage & Mat'l Certs

0.00



Packaging

Memo

0.00

Packaging

Ensure certificate of conformity is attached

★ SEE WID CHG ATTACHED

Pep/s ①  
P12/4/21 ①

170

QC5- Inspect part completeness to step on W/O

0.00



QC

Memo

0.00

Quality Control

Perch-

issue P/O: 17282 NDT

CZ 12/06/12 ①

rec'd

attached cufc

Pep/s ①

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

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Required Date: 10/6/2011 Req'd Qty: 1.00

Customer:

Reference:

Approvals:

Process Plan:

Date:

Tooling:

Date:

Run Start

QC:

Date:

SPC (Y/N):

Date:

Stop

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
--------------------------------	--------------------------	----------------------	---------	--------	--------------	---------------	---------------	------------------	----------------

180

0.00



SprayPaint

SprayPaint

Memo

0.00

Spray Painting

1-Prime inside crosstube as per QSI 005 4.2  
2-Paint Outside of Tube as per Dart QSI 005 4.2

1

12-06-24

190

0.00



QC14- Inspect Spray Paint

QC

Memo

0.00

Quality Control

Then, Wrap in plastic bag to protect from scratches

6

12-06-25 (x1)

200

0.00



Crosstubes

Crosstubes

Memo

0.00

Crosstubes

1-Install Ground wire Insert, then insert screw and washer  
2-Install Abrasion strips as per Dwg D350-748-241 & QSI 035.  
3-Install supports Using Dt8876 as per Dwg D350-748-241, Torque to 60-80 IN-LBS

1

12-06-25

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

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Cust Item ID:

Required Date: 10/6/2011 Req'd Qty: 1.00



Customer:

Reference:

Run Start



Approvals: Process Plan: \_\_\_\_\_ Date: \_\_\_\_\_ Tooling: \_\_\_\_\_ Date: \_\_\_\_\_

Stop



QC: \_\_\_\_\_ Date: \_\_\_\_\_ SPC (Y/N): \_\_\_\_\_ Date: \_\_\_\_\_

Sequence ID/  
Work Center IDOperation  
DescriptionSet Up/  
Run Hours

Tool ID

Tool #

Plan  
CodeAccept  
QtyReject  
QtyReject  
NumberInsp.  
Stamp

210

QC5- Inspect part completeness to step on W/O

0.00



QC

Memo

0.00

Quality Control

0 0 12-06-25

220

Pick Kit

0.00



Packaging

Memo

0.00

Packaging

230

QC4- 100% Inspect kits for completeness

0.00



QC

Memo

0.00

Quality Control

W/O:		WORK ORDER CHANGES					
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Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

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Customer:

Reference:

Run Start



Approvals: Process Plan: \_\_\_\_\_ Date: \_\_\_\_\_ Tooling: \_\_\_\_\_ Date: \_\_\_\_\_

Stop



QC: \_\_\_\_\_ Date: \_\_\_\_\_ SPC (Y/N): \_\_\_\_\_ Date: \_\_\_\_\_

Sequence ID/ Work Center ID	Operation Description	Set Up/ Run Hours	Tool ID	Tool #	Plan Code	Accept Qty	Reject Qty	Reject Number	Insp. Stamp
240		0.00							
	Packaging								
Packaging	Memo	0.00							
Packaging	Identify and pack for shipping as per PPPD350-748-201								
	Location: _____								
	PPP Rev: _____								
250	QC21- Final Inspection - Work Order Release	0.00							
QC	Memo	0.00							
Quality Control									

**POSITIVE RECALL**  
EFFECTIVE 12/16/21 AUTH OP  
RELEASED 12/7/16 DATE OP  
D.S. APPROVAL OF  
O.D. DIMS

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

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# Picklist Print

Page 1

Thursday, September 15, 2011 3:58:13 PM

Work Order ID: 73808

Parent Item: D350-748-201

Parent Item Name: Crosstube Installation, High Aft

Start Date: 9/15/2011

Required Date: 10/6/2011

Start Qty: 1.00

Required Qty: 1.00

Comments: IPP Rev: A New Issue 06-07-05 JLM  
 IPP Rev: B Update qty of MS21042L5 06-09-12 KJ  
 IPP Rev C Combined manufacturing 08.04.02 EC verified by: DD  
 IPP Rev:D 08-06-24 revD as per dwg DD verified by:EC  
 IPP Rev: E 08.12.11 Step17 was step 21 KJ Verified by:EC IPP Rev:F  
 10.08.04 added QSI010 4.3 DD verf:EC

Component Item ID/ Item Name	Replacement Item ID	Mfg/ Purch	Bin Item	Primary Location	Last Location	Route Seq ID	Unit of Measure	Qty on Hand	Qty per Kit	Total Qty	Qty Issued	Date Issued	Status
D350-748-241TRN		Manufactured	No			110	Each	9.0000	1	1			
Crosstube Turning Detail													

Location Loc Qty Loc Code

LG	83642	8	
61314		0	
61315		0	
68838		1	
68839		1	
68841		1	
70654		1	
72330		1	
72331		1	
72332		1	
72333		1	
LG003		1	
68840		1	

ALS4-1032-225

Purchased

No

200

Each

1,895.000

1

1

Insert

Location Loc Qty Loc Code

ST282		1895	
110768		62	
117717		9	
118386		860	
118696		964	

B# 118520

12-06-25

①

12-6-7

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

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Start Date: 9/15/2011

Required Date: 10/6/2011

Start Qty: 1.00

Required Qty: 1.00

AN960JD10 NAS1149D0363J Purchased No

200 Each

0.0000

1

1



B# 121524



M 12 06 25

Washer

D2856-400

Manufactured No

200

f

208.9845

1.181

1.243158



M 12 06 25

Abraison Strip

## Location

## Loc Qty

## Loc Code

ST403

0.3149

68076

0.3149

ST409

208.6696

63735

0.6696

71164

208

1 - cut as per dwg D2856

D3502-1

Manufactured No

200

Each

43.0000

2

2



M 12 06 25

Support

## Location

## Loc Qty

## Loc Code

ST063

43

61206

7

64004

10

68951

12

72129

14

MS21920-20

Purchased

No

200

Each

74.0000

2

2



M 12 06 25

Clamp (per MIL-DTL-8783C)

## Location

## Loc Qty

## Loc Code

LG050

74

116799

10

118236

18

118649

46

B# 121067

W/O:		WORK ORDER CHANGES					
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Required Date: 10/6/2011

Start Qty: 1.00

Required Qty: 1.00

MS27039-1-10

Purchased

No

200

Each

295.0000

1

1



Screw

ST 122027

Location

Loc Qty

Loc Code

ST290

95

117441

95

ST291

200

118612

200

AN4-41A

Purchased

No

220

Each

309.0000

8

8



Bolt

Location

Loc Qty

Loc Code

ST360

309

115108

34

115705

50

116191

50

117619

50

117795

25

118451

50

118838

50

AN4-6A

Purchased

No

220

Each

1,216.000

16

16



Bolt

Location

Loc Qty

Loc Code

ST356

1200

117872

200

118422

300

118628

400

118838

300

ST358

16

117514

16

W/O:		WORK ORDER CHANGES					
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Start Date: 9/15/2011

Required Date: 10/6/2011

Start Qty: 1.00

Required Qty: 1.00

AN5-32A Purchased No 220 Each 172.0000 4 4



Bolt



<u>Location</u>	<u>Loc Qty</u>	<u>Loc Code</u>
ST339	50	
118628	50	
ST340	122	
117161	1	
117872	60	
118191	11	
118422	50	

AN960JD416 NAS1149D0463J Purchased No 220 Each 0.0000 32 32



Washer

AN960JD516 NAS1149D0563J Purchased No 220 Each 0.0000 8 8



Washer

D3500-1 Manufactured No 220 Each 16.0000 4 4



Saddle

<u>Location</u>	<u>Loc Qty</u>	<u>Loc Code</u>
ST424	9	
66127	9	
ST424/25	7	
62207	7	

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Start Date: 9/15/2011

Required Date: 10/6/2011

Start Qty: 1.00

Required Qty: 1.00

D3501-1 Manufactured No 220 Each 245.0000 16 16



Bushing

Location Loc Qty Loc Code

ST063	202	
68939	102	
70682	100	
ST066	43	
67757	43	

MS21042L4 Purchased No 220 Each 3,501.000 24 24



Nut

Location Loc Qty Loc Code

ST300	3501	
117441	51	
117601	637	
117885	813	
118451	2000	

MS21042L5 Purchased No 220 Each 1,295.000 4 4



Nut

Location Loc Qty Loc Code

ST300	1295	
116105	5	
116548	53	
117441	351	
117611	90	
118179	496	
118910	300	

W/O:		WORK ORDER CHANGES					
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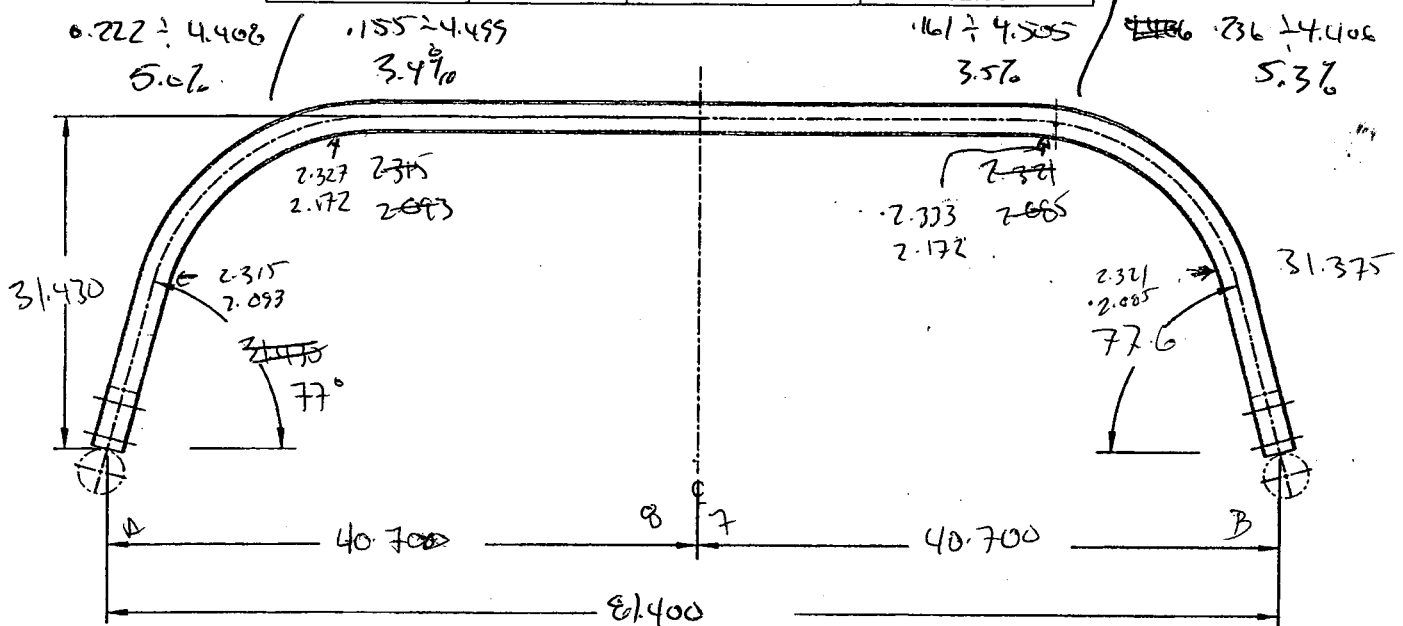
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			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries



DART AEROSPACE LTD		Work Order:	73808
Description: Crosstube High Aft (AS350/355)		Part Number:	D350-748-201
Inspection Dwg: D350-748-241 Rev: E		Page 1 of 1	

Required Dimension	Min	Max
Height	31.22	31.48
1/2 Span	40.77	41.03
Angle	75	77
Total Span	81.54	82.06



Comments
twist = $0.121''$ bottom
Side A = $5.0\%$ @ end of Bend / $3.4\%$ at top of Bend
Side B = $5.3\%$ @ Bottom of Bend / $3.5\%$ at top of Bend

QC15 Inspection	
Date	

Rev	Date	Change	Revised by	Approved
A	07.02.06	New Issue	KJ/JM	
B	10.08.23	Dwg Rev updated	KJ	

Item	Qty -241	Part Number	Description
1	X	D350-748-241	CROSSTUBE ASSEMBLY (AS 350/355 HI AFT)
2	1	D6015-125	CROSSTUBE (OR D6018-125)
3	2	D3502-1	SUPPORT
4	2	D2856-400-710	ABRASION STRIP
5	1	AELS-1032-225	INSERT
6	1	NAS1149D0363J	WASHER (OR AN960JD10)
7	2	MS21920-20	CLAMP (PER DART SPEC. M-MS21920-20)
8	1	MS27039-1-10	SCREW

#### GENERAL NOTES:

- 1) MATERIAL: MANUFACTURED FROM D6015-125 OR D6018-125  
FINISHED LENGTH = 122.700±0.06
- 2) FINISH: MAGNETIC PARTICLE INSPECT PER DART QSI 038 4.2  
CADMIUM PLATE PER AMS-QQ-P-416B, CLASS 1, TYPE II  
PRIME INSIDE AND OUTSIDE PER DART QSI 005 4.2  
PAINT OUTSIDE PER DART QSI 005 4.2
- 3) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED.
- 4) UNITS: INCHES UNLESS OTHERWISE NOTED.
- 5) BREAK SHARP EDGES: 0.005 TO 0.010 MAX
- 6) IDENTIFICATION: DART PART NUMBER "D350-748-241" AND BATCH NUMBER ON INSIDE OF CUFF  
PER DART QSI 044 6.4 (VIBRATING STYLUS)
- 7) WEIGHT: 29.85 lbs
- 8) PART IS SYMMETRIC ABOUT CENTERLINE, EXCEPT FOR Ø0.297 HOLE.
- 9) RUN CUTTER OFF PART WHERE INDICATED. BLEND OUT ALL EDGES FROM MACHINING  
LONGITUDINALLY, TRANSITION SHOULD BE SMOOTH. NOTE: ALL HOLES ARE DRILLED AFTER  
BENDING.
- 10) BEND PROGRESSIVELY WITH A MINIMUM OF 7 PASSES. MAXIMUM TUBE FLATTENING DUE TO  
BENDING IS 6% BASED ON O.D.
- 11) HEAT TREAT TO MIN. 180 KSI PER MIL-T-6736 OR AMS 2759-1C AFTER TURNING. ACCEPTABLE TO  
VERIFY TENSILE STRENGTH BY HARDNESS TEST PER ASTM E18 TO 40-45 HRC.
- 12) INSTALL D2856-400-710 ABRASION STRIPS WITH A GAP ON BOTTOM SIDE OF CROSSTUBE,  
CENTERED OPPOSITE D3502-1 SUPPORT, PER QSI 035.
- 13) EXTREME CARE MUST BE TAKEN TO PROTECT THE OUTSIDE SURFACE OF THE TUBE. THE  
OUTSIDE SURFACE MUST BE SMOOTH AND FREE FROM SURFACE DEFECTS SUCH AS SCRATCHES,  
NICKS, OR DENTS. DEFECTS UP TO 0.005" MAY BE BLENDED OUT LONGITUDINALLY.  
CIRCUMFERENTIAL GRIND MARKS ARE UNACCEPTABLE. WHEN DRILLING HOLES EXTREME CARE  
MUST BE TAKEN AND CAREFUL DEBURRING PERFORMED TO ENSURE A CLEAN HOLE WITH NO  
CRACKING/CHIPPING/GROOVES.
- 14) TORQUE CLAMPS 60 TO 80 IN-LB. ENSURE AT LEAST 1.5 THREADS SHOWING IN SAFETY AND THAT  
NUT HAS NOT BOTTOMED-OUT AFTER TORQUING.
- 15) MAX TWIST AFTER BENDING: WITH XTUBE LAYED FLAT ON SURFACE, THE DIFFERENCE BETWEEN  
CUFF HEIGHTS FROM THE SURFACE MAY BE NO LARGER THAN 0.25 (ZN C1-3).

SHOP COPY  
RETURN TO  
ENGINEERING  
UNCONTROLLED  
SUBJECT TO AMENDMENT  
WITHOUT NOTICE  
WORK ORDER  
NO. 73808  
11-0915

RELEASED  
2011-01-08

F	ADD HRC TEST OPTION (B8-1) PER PAR 09-040, ADD TWIST LIMIT (A8-1, C1-3), ADD D6015-125 OPTION (C8-1), STOCK DIM NOW MACHINED (D1-4)	CP	10.11.23
E	REVISE GENERAL NOTES: UPDATE TO CURRENT STANDARDS; RELOCATED FLAG #6 PER PAR 08-046 (ZN A8-3); ADD TOLERANCES (ZN C6-3, D2-3)	RF	09.09.30
D	MAG. PARTICLE AND CAD PLATE AS MFD.	CP	06.10.31
C	ADD CAD PLATING	CP	06.08.14
B	ADD D6018-125 & PRIME AND PAINT	CP	06.06.30
A	NEW ISSUE	CP	06.03.31
REV.	DESCRIPTION	BY	DATE
DESIGN	DP	<b>DART AEROSPACE LTD</b> HAWKESBURY, ONTARIO, CANADA	
DRAWN	DP		
CHECKED	DP	DRAWING NO.	REV. F
MFG. APPR.	DP	D350-748-241	SHEET 1 OF 4
APPROVED	DP	TITLE	SCALE
DE APPR.	DP	CROSSTUBE (AS 350/355 HI AFT)	NTS
DATE	10.11.23	COPYRIGHT © 2006 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL. ANY DISSEMINATION OR REPRODUCTION OF THIS DOCUMENT WITHOUT THE WRITTEN PERMISSION FROM DART AEROSPACE LTD IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.	

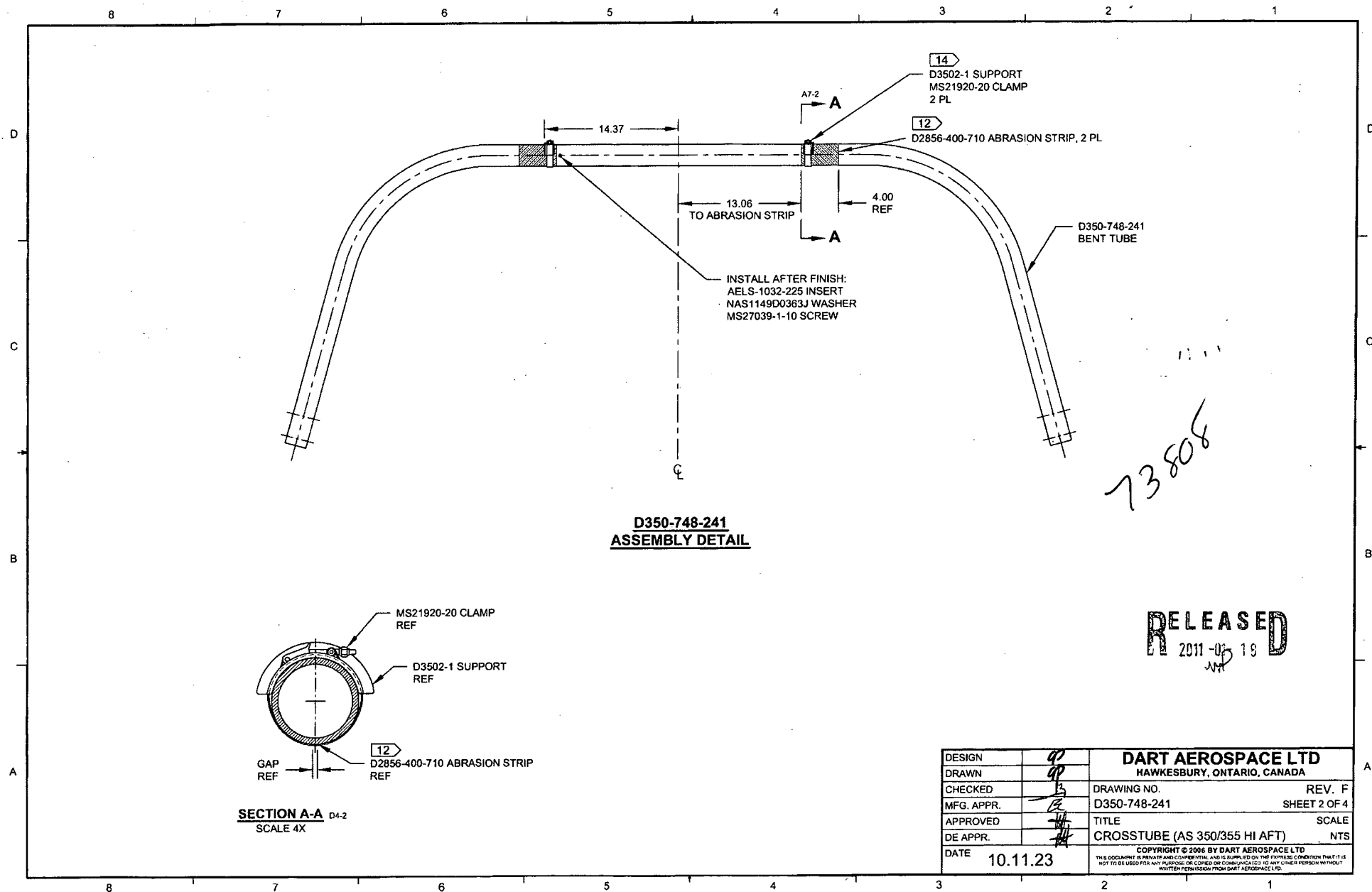
W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries



RELEASED  
2011-03-19

DESIGN	9P	<b>DART AEROSPACE LTD</b>	
DRAWN	9P	HAWKESBURY, ONTARIO, CANADA	
CHECKED	13	DRAWING NO.	REV. F
MFG. APPR.	13	D350-748-241	SHEET 2 OF 4
APPROVED	13	TITLE	SCALE
DE APPR.	13	CROSSTUBE (AS 350/355 HI AFT)	NTS
DATE	10.11.23	<small>COPYRIGHT © 2006 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL, AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD.</small>	

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

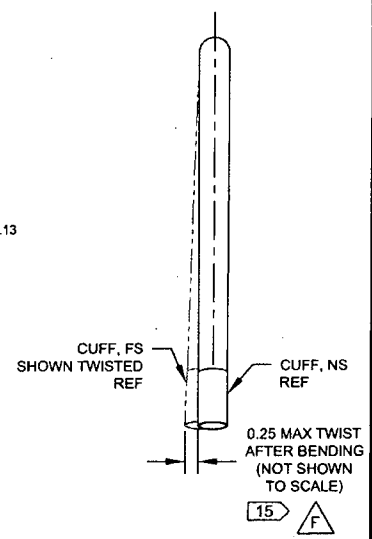
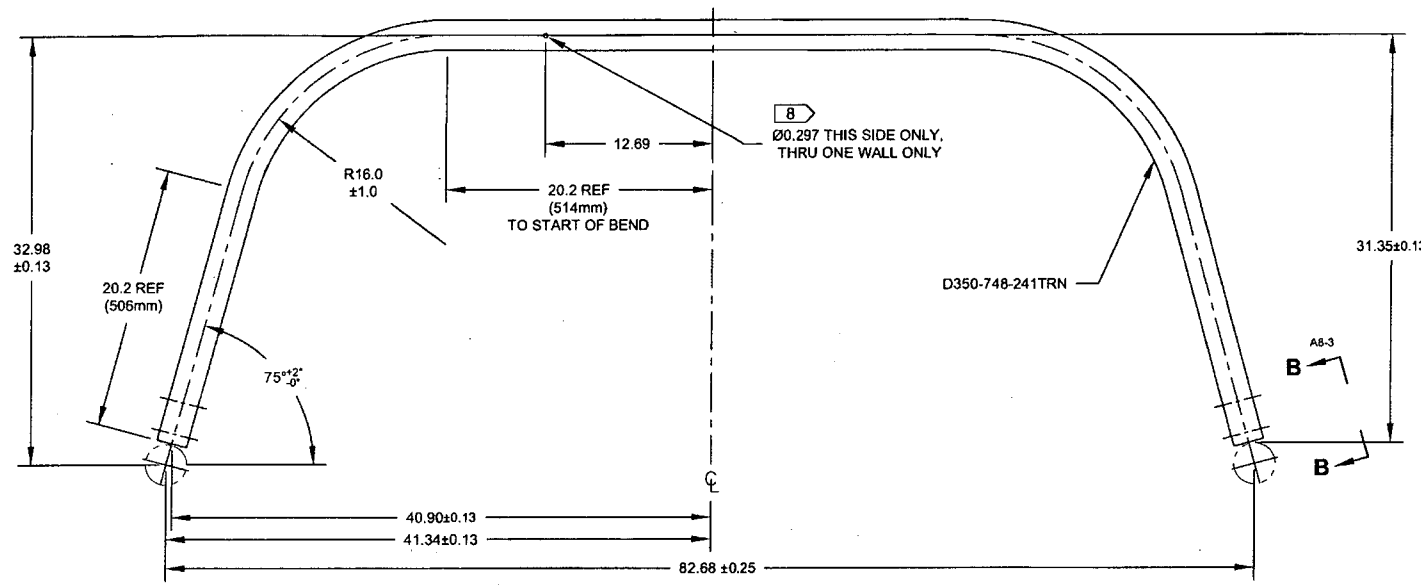
Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

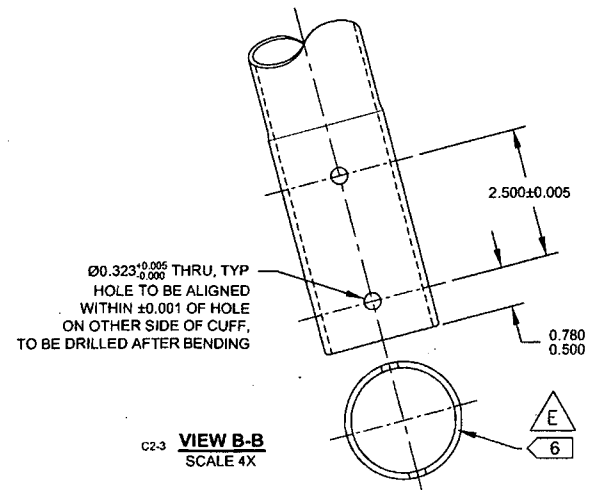
NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries

8 7 6 5 4 3 2 1



**D350-748-241**  
**BENDING AND DRILLING DETAIL** 10



C2-3 **VIEW B-B**  
SCALE 4X

**RELEASED**  
2011-01-18

73803

DESIGN		<b>DART AEROSPACE LTD</b>	
DRAWN		HAWKESBURY, ONTARIO, CANADA	
CHECKED		DRAWING NO.	REV. F
MFG. APPR.		D350-748-241	SHEET 3 OF 4
APPROVED		TITLE	SCALE
DE APPR.		CROSSTUBE (AS 350/355 HI AFT)	NTS
DATE	10.11.23	<small>COPYRIGHT © 2006 BY DART AEROSPACE LTD THIS DOCUMENT IS PRIVATE AND CONFIDENTIAL AND IS SUPPLIED ON THE EXPRESS CONDITION THAT IT IS NOT TO BE USED FOR ANY PURPOSE OR COPIED OR COMMUNICATED TO ANY OTHER PERSON WITHOUT WRITTEN PERMISSION FROM DART AEROSPACE LTD</small>	

8 7 6 5 4 3 2 1

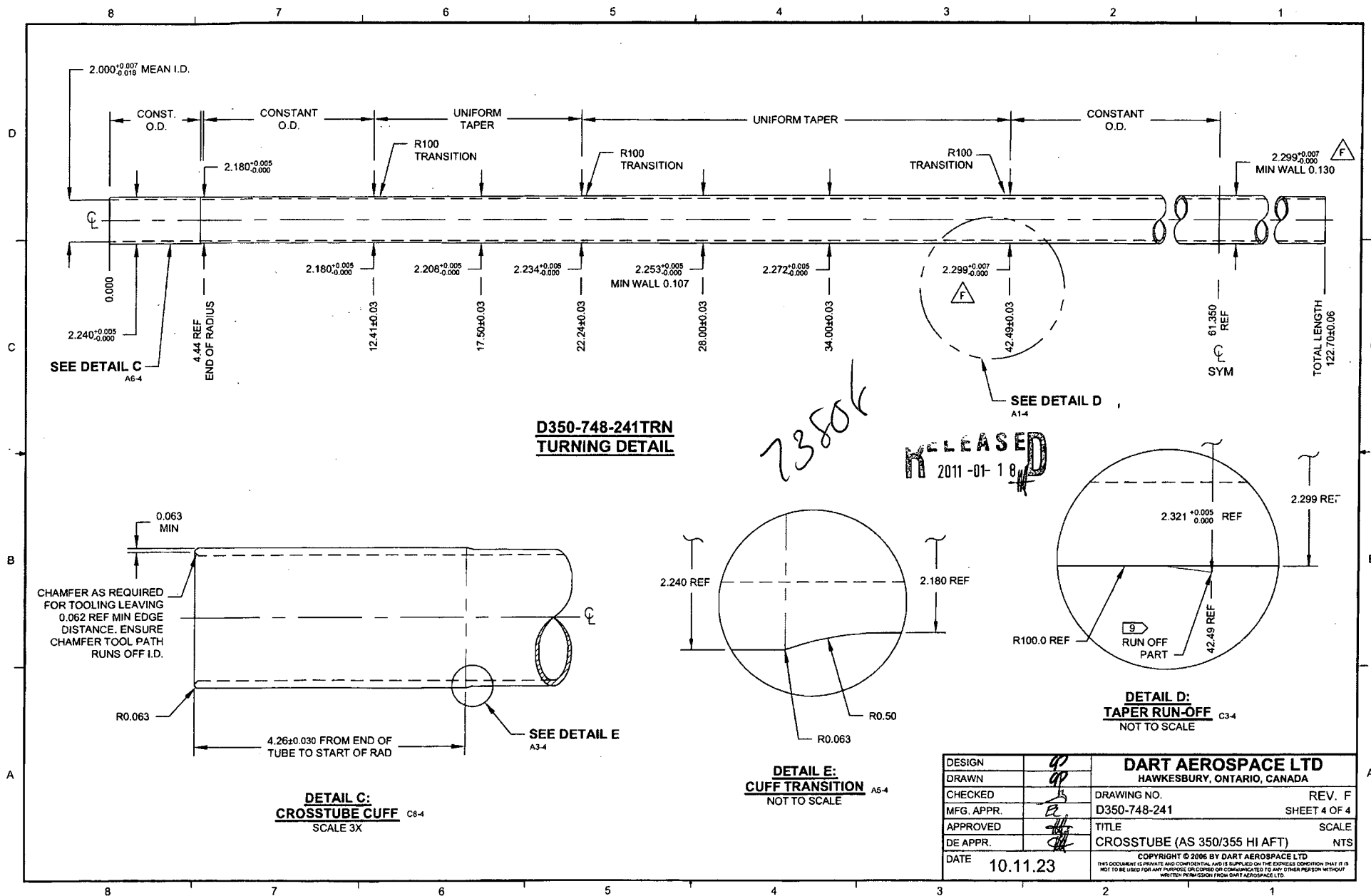
W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries





W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries

<b>DART AEROSPACE LTD</b>		<b>Work Order:</b> B86342
<b>Description:</b> Crosstube Assembly (AS350/355 High Aft)		<b>Part Number:</b> D350-748-241
<b>Inspection Dwg:</b> D350-748-241 <b>Rev:</b> F		<b>Page 1 of 1</b>

### FIRST ARTICLE INSPECTION CHECKLIST

Inspection Sheet	Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
SIDE A	2.240	+0.005/-0.000	2.229	✓	✓	VERN	CNC - 08
	2.180	+0.005/-0.000	2.180	✓			
	2.180	+0.005/-0.000	2.180	✓			
	2.208	+0.005/-0.000	2.212	✓			
	2.234	+0.005/-0.000	2.239	✓			
	2.253	+0.005/-0.000	2.253	✓			
	2.272	+0.005/-0.000	2.270	✓	✓		
	2.299	+0.005/-0.000	2.291		✓		
	0.063	+/-0.010	.063	✓	✓	R6	
	4.26	+/-0.030	4.26	✓	✓		
	R0.063	+/-0.010	.063	✓		R6	
	R0.50	+/-0.030	.5	✓		R6	
SIDE B	2.240	+0.005/-0.000	2.241	✓		VERN	CNC - 03
	2.180	+0.005/-0.000	2.184	✓			
	2.180	+0.005/-0.000	2.184	✓			
	2.208	+0.005/-0.000	2.219	✓			
	2.234	+0.005/-0.000	2.236	✓			
	2.253	+0.005/-0.000	2.253	✓			
	2.272	+0.005/-0.000	2.277	✓			
	2.299	+0.005/-0.000	2.297	✓	✓		
	0.063	+/-0.010	.063	✓		R6	
	4.26	+/-0.030	4.26	✓			
	R0.063	+/-0.010	.063	✓		R6	
	R0.50	+/-0.030	.5	✓		R6	
	122.70	+/-0.060	122.75	✓		TAPE	MM - 02.

<b>Measured by:</b> KC	<b>Audited by:</b>	<b>Preliminary Approval:</b>
<b>Date:</b> 12-6-06	<b>Date:</b>	<b>Date:</b>

Rev	Date	Change	Revised by	Approved
A	07.01.17	New Issue (P/O D350-748-201)	KJ/JLM	
B	12.02.02	Dwg Rev updated	KJ	

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

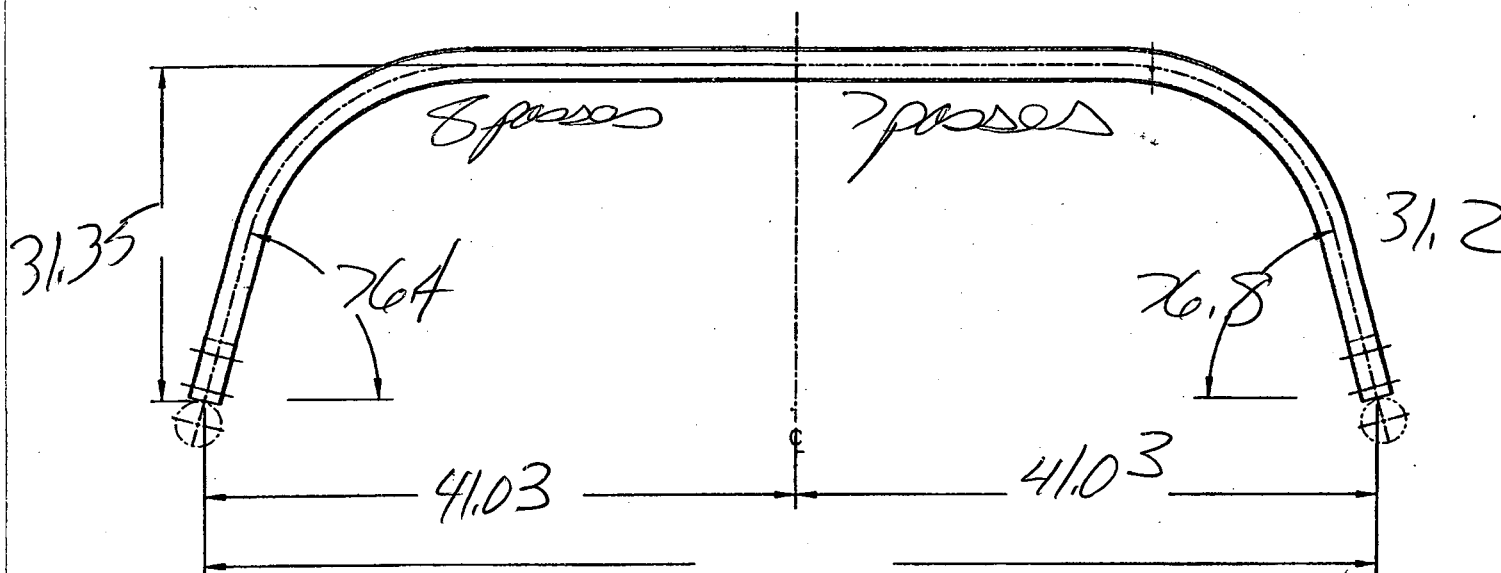
NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

**NOTE:** Date & initial all entries

DART AEROSPACE LTD		Work Order:	73808
Description: Crosstube High Aft (AS350/355)		Part Number:	D350-748-201
Inspection Dwg: D350-748-241		Rev: E	Page 1 of 1

Required Dimension	Min	Max
Height	31.22	31.48
1/2 Span	40.77	41.03
Angle	75	77
Total Span	81.54	82.06

REFERENCE ONLY



Comments

QC15 Inspection	
Date	

Rev	Date	Change	Revised by	Approved
A	07.02.06	New Issue	KJ/JM	
B	10.08.23	Dwg Rev updated	KJ	<i>[Signature]</i>

11/10/77

11/10/77

11/10/77

11/10/77

11/10/77

11/10/77

# METCOR INC.

560 BOUL. ARTHUR-SAUVÉ  
ST-EUSTACHE, QC J7R 5A8  
Tel: 450-473-1884 / Fax: 450-491-5498

## Recu de Livraison

Order	Shipper	Shipping Seq.
176670	1	61651

Shipped Complete

**Customer** **215**

**DART AEROSPACE**  
1270 ABERDEEN  
HAWKESBURY, ON K6A 1K7  
Ph: 613-632-5200  
Fax: 613-632-1053

**Shipped To:**

**DART AEROSPACE**  
1270 ABERDEEN  
HAWKESBURY, ON K6A 1K7  
Ph: 613-632-5200  
Fax: 613-632-1053

Purchase Order Number	Customer Shipper No.	Material Type	Order Date	Carrier
PO17159		Steel	2012/6/7	PICK UP
Quantity	Part No. / Part Name / Part Description			Pounds
5	D350-748-101 CONTENANT: 1 PALETTE			150,

Container Type	# Of Containers	Container Comments
PALETTE	1	
CERTIFICAT		

<b>PACKING</b>	
----------------	--

Quantity Shipped: 5  
Pounds Shipped: 150,00  
Quantity Remaining: 0  
Pounds Remaining: 0,00

CERTIFICAT

Quantity Shipped: 5

Pounds Shipped: 150,00

Signature:

Date:

# METCOR INC.

560 BOUL. ARTHUR-SAUVÉ  
ST-EUSTACHE, QC, J7R 5A8

Tel: 450-473-1884 / Fax: 450-491-5498

## Certificat de Conformité Détaillé

Detailed Certificate of Compliance

BON DE TRAVAIL order	CHARGEMENT load
176670	1

CLIENT / customer 215

DART AEROSPACE  
1270 ABERDEEN  
HAWKESBURY

ON K6A 1K7

LIVRÉ À / shipped to:

DART AEROSPACE  
1270 ABERDEEN  
HAWKESBURY

ON K6A 1K7

1

COMMANDE DU CLIENT customer po	BON DE LIVRAISON DU CLIENT customer shipper no.	MATÉRIEL material	CODE DE TRAITEMENT mat'l heat code	NUMÉRO DE LOT lot number
PO17159		Steel		

### SPÉCIFICATIONS DU PROCÉDÉ

processing specifications

STRESS REL

SAE AMS 2759/1 REV.E

EXIGENCE / requirement SPÉCIFICATIONS / specified TESTS EXÉCUTÉS / performed RÉSULTATS DE TESTS / results

Visual

QUANTITÉ quantity	POIDS weight	DESCRIPTION DES PIÈCES parts description
5	150	D350-748-201 (1) CROSSTUBE REFERENCE: 73806  (1) D350-748-201 CROSSTUBE REFERENCE: 73808  (1) D350-748-201 CROSSTUBE REFERENCE: 73809  (1) D350-748-201 CROSSTUBE REFERENCE: 85335  (1) D350-748-201 CROSSTUBE REFERENCE: 85402  CONTENANT: 1 PALETTE

Operation	Temp. spécifiée Specified Temp	Temps de trempe Spécifié Specified Soak Temp	Atmosphere	Carbone Carbon Potential	Q-Media Q-Temp	Four # Furnace #	Date Départ Start Date	Heure d'entrée Time In	Heure de sortie Time Out	Date Complétée Date complete
1.00 CONT. INIT.	LAVAGE		si nécessaire							

# METCOR INC.

560 BOUL. ARTHUR-SAUVÉ  
ST-EUSTACHE, QC, J7R 5A8

Tel: 450-473-1884 / Fax: 450-491-5498

## Certificat de Conformité Détaillé

Detailed Certificate of Compliance

BON DE TRAVAIL order	CHARGEMENT load
176670	1

CLIENT / customer 215

DART AEROSPACE  
1270 ABERDEEN  
HAWKESBURY

ON K6A 1K7

LIVRÉ À / shipped to:

DART AEROSPACE  
1270 ABERDEEN  
HAWKESBURY

ON K6A 1K7

Operation	Temp. spécifiée Specified Temp	Temps de trempé Spécifié Specified Soak Temp	Atmosphere	Carbone Carbon Potential	Q-Media Q-Temp	Four # Furnace #	Date Départ Start Date	Heure d'entrée Time In	Heure de sortie Time Out	Date Complétée Date complete
2.00 PREPARING	COMPTAGE									
3.00 STRESS RE	343 +/-25°C	2:30 hrs	air			701				
4.00 FINAL INSP							06-08-2012			06-08-2012

### COMMENTAIRES / comments

ALL THE HEAT TREATMENT PROCESSING PERFORMED ON THIS ORDER WAS ACCOMPLISHED USING HEAT TREATMENT EQUIPEMENT THAT MEETS THE REQUIREMENTS OF AMS 2759. ALL THE HEAT TREATMENT OPERATIONS WERE ACCOMPLISHED IN ACCORDANCE WITH THE REQUESTED/REQUIRED HEAT TREATMENT SPECIFICATION AND ALL REQUIRED VERIFICATIONS TEST HAVE BEEN PERFORMED AND DOCUMENTED. NO UNAUTHORIZED CHANGES OR DEVIATIONS TO REQUIRED HEAT TREATMENT SPECIFICATIONS OR PROCEDURES HAVE BEEN PERFORMED.

APPROUVÉ par / Approved by:

*[Signature]*



DATE: 2012-06-08

/ Nous certifions que toute l'information comprise sur ce rapport est exacte et conforme aux requis du client./We certify that all the information on this report is exact and in accordance with the order requirements.





**CERTIFICATE OF  
CONFORMANCE**

**CADORATH PLATING CO. LTD.  
2150 LOGAN AVENUE  
WINNIPEG, MANITOBA R2J-0J1**

**DATE:** Jun-20-2012

**CONSIGNED TO:** Dart Aerospace Ltd.  
1270 Aberdeen St.  
Hawksbury, ON K6A 1K7

**W/O #:** 115266  
**INVOICE #:** 60974

**CONTRACT OR  
PURCHASE ORDER #** PO17184

**DESCRIPTION:** CROSSTUBE

**QTY** 1

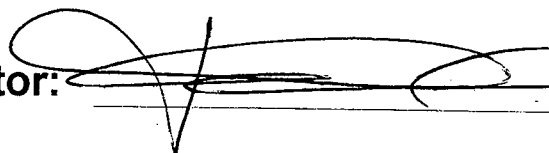

**P/N #** D350-748-201

**S/N #** 73808

STRESS RELIEF BAKE HEAT CHART # 12-589. MPI IAW ASTM-E-1444. CADMIUM PLATE IAW AMS-QQ-P-416C TYPE 2 YELLOW CLASS 2. BAKE HEAT CHART #12-604. MPI IAW ASTM-E-1444.

**CERTIFICATE:** I certify that the items indicated here on have been inspected and tested and conform to all specifications and requirements detailed on the contract or purchase order.

**Approved Inspector:**

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector
11.10.13	161	LOAD TUBE TO 3000 <sup>lb</sup> FOR 1 MINUTE REF D.S. EMAIL		CP 12/6/12		CP 12/6/12	
11.10.13	162	NDT TUBE					

Part No: \_\_\_\_\_ PAR #: \_\_\_\_\_ Fault Category: \_\_\_\_\_ NCR: Yes No DQA: \_\_\_\_\_ Date: \_\_\_\_\_

Resolution: \_\_\_\_\_ Disposition: \_\_\_\_\_ QA: N/C Closed: \_\_\_\_\_ Date: \_\_\_\_\_

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries



## LIQUID PENETRANT TEST REPORT

P- 12189

CLIENT DART AeroSpace DATE JUNE 27/2012 PAGE 1 OF 1  
ATTENTION LINDA / MATT ACUREN JOB NO. 188-12-00270 TIME AM ☒ PM ☐  
ADDRESS 1270 A BENDEN ST. POWO No. -  
HAWKESBURY, ON. WORK LOCATION SAME  
ACCEPTANCE STD. ASTM 1417/051-030 REV./DATE 2005  
PROJECT F.P.I. ON CROSS TUBES  
ITEM(S) EXAMINED 9 PCS

JOB DESCRIPTION PROCEDURE No. LT 0002 REV./DATE 2008 TECHNIQUE No. LT 1417 REV./DATE 2008  
PART NO. SEE RESULTS MATERIAL STEEL / ALUMINUM THICKNESS VARIOUS  
SCOPE A DET FLUORESCENT PENETRANT INSPECTION WAS CARRIED OUT ON THE EXTERNAL SURFACE 100%

TEST DETAILS  
METHOD ☒ FLUORESCENT ☐ VISIBLE ☒ WATER WASH ☐ SOLVENT REMOVABLE ☐ POST EMULSIFIED  
FAMILY BRAND MAGNA FLUX BLACK LIGHT S/N 1809 ☐ OUTPUT > 1000  $\mu$ W/cm<sup>2</sup> ☐ AMBIENT < 2 fc  
PENETRANT 2LG7 MINIMUM DWELL TIME 10 MIN. LIGHTING EQUIP. ☐ FLASHLIGHT ☐ TROUBLELIGHT ☐ OUTPUT > 100 fc @ SURFACE  
PENETRANT REMOVER H2O MINIMUM DRY TIME > 10 MIN. OTHER LABINO  
DEVELOPER SK052 MINIMUM DWELL TIME 10 MIN. LIGHT METER S/N 1098866 CAL DUE DATE JULY 28/2012  
DEVELOPER TYPE ☒ NON AQUEOUS ☐ AQUEOUS ☐ DRY

TEST SURFACE  
SURFACE CONDITION ☐ AS GROUND ☐ AS WELDED ☒ MACHINED ☐ SHOT BLASTED ☒ CLEAN BARE METAL  
SURFACE TEMPERATURE ☐ < -4°C/20°F ☐ -4°C/20°F TO 10°C/50°F ☒ 10°C/50°F TO 52°C/125°F ☐ > 52°C/125°F

RESULTS- ☒ METRIC ☐ IMPERIAL

W.O. #	COMMENTS	ACCEPT	REJECT
1 - 85335	" "	✓	
1 - 73809	" "	✓	
1 - 85402	" "	✓	
1 - 73808	" "	✓	
1 - 73806	" "	✓	
1 - 84184	" "	✓	
1 - 84185	" "	✓	
1 - 84527	" "	✓	
1 - 84526	" "	✓	

STEEL TUBES  
ALUMINUM TUBES

Scope of Services  
The agreement of Acuren Group Inc. to perform services extends only to those services provided for in writing. Under no circumstances shall such services extend beyond the performance of the requested services. It is expressly understood that all descriptions, comments and expressions of opinion reflect the opinions or observations of Acuren Group Inc. based on information and assumptions supplied by the owner/operator and are not intended nor can they be construed as representations or warranties. Acuren Group Inc. is not assuming any responsibilities of the owner/operator and the owner/operator retains complete responsibility for the engineering, manufacture, repair and use decisions as a result of the data or other information provided by Acuren Group Inc. In no event shall Acuren Group Inc.'s liability in respect of the services referred to herein exceed the amount paid for such services.

Standard of Care  
In performing the services provided, Acuren Group Inc. uses the degree, care and skill ordinarily exercised under similar circumstances by others performing such services in the same or similar locality. No other warranty, expressed or implied, is made or intended by Acuren Group Inc.

SIGNATURES  
CLIENT REPRESENTATIVE Andy Sheldon PRINT ASheldon SIGNATURE  
TECHNICIAN (SIGNATURE): Mike Harkin 1<sup>st</sup> TECHNICIAN  
NAME (PRINT): Mike Harkin 2<sup>nd</sup> TECHNICIAN  
CGSB LEVEL II SNT LEVEL II CGSB LEVEL II SNT LEVEL II  
CGSB REG. No. 6006 CGSB REG. No. 6006

DTR # E-63661  
REPORT REVIEWED BY: NAME INITIALS

WHITE - CLIENT COPY

CANARY - OFFICE COPY

PINK - TECHNICIAN COPY

GOLD - OFFICE COPY